

## IN THE CLAIMS

1. (Cancelled)

2. (Previously Presented) A method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect the electron emission portions are disposed on a substrate, the method comprising:

a wiring forming step of forming at least one wiring on the substrate; and  
an electron emission portion forming process of forming the electron emission portions on the substrate,

wherein an electric field applying process of applying a given electric field to the substrate on which the at least one wiring is formed is conducted using an electrode opposing a surface on the substrate on which the at least one wiring is formed, after the wiring forming step is completed and before said electron emission portion forming process is completed, and wherein the electric field is 1kV/mm or more in its electric field intensity.

3. (Previously Presented) A method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect the electron emission portions are disposed on a substrate, the method comprising:

a wiring forming step of forming at least one wiring on the substrate;  
and

an electron emission portion forming process of forming the electron emission portions on the substrate;

wherein an electric field applying process of applying a given electric field to the substrate on which the at least one wiring is formed is conducted after said wiring forming step is completed and before said electron emission portion forming process is completed, and

wherein said electric field applying process comprises a step of discharging, by application of the electric field, electricity from a portion of the substrate from which electricity is liable to be discharged in various processes after said electric field applying process including said electron emission portion forming process, or when said electron beam device is used, to thereby change the portion of the substrate into a shape which is difficult to discharge electricity.

4. (Previously Presented) The method of manufacturing the electron beam device according to claim 2, wherein said electron emission portion forming step includes an electrode forming step of forming a pair of electrodes to which different potentials are given from the wirings in correspondence with respective ones of the electron emission portions, and said electric field applying process is conducted before said electrode forming step is conducted.

5. (Previously Presented) The method of manufacturing the electron beam device according to claim 4, wherein the pair of electrodes comprise a pair of electrodes that constitute surface conduction type electron emission elements.

6. (Previously Presented) The method of manufacturing the electron beam device according to claim 5, wherein said electrode forming step comprises a step which includes a thin film forming step of forming an electrically conductive thin film on

the substrate, and produces a gap in the electrically conductive thin film and constitutes the pair of electrodes by the electrically conductive thin film which exists on both sides of the gap.

7. (Previously Presented) A method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect the electron emission portions are disposed on a substrate, the method comprising:

a wiring forming step of forming at least one wiring on the substrate;

and

an electron emission portion forming process of forming the electron emission portions on the substrate,

wherein an electric field applying process of applying a given electric field to the substrate on which the at least one wiring is formed is conducted after said wiring forming step is completed and before said electron emission portion forming process is completed,

wherein said electron emission portion forming step includes an electrode forming step of forming a pair of electrodes to which different potentials are given from the wirings in correspondence with respective ones of the electron emission portions, and said electric field applying process is conducted before said electrode forming step is conducted,

wherein the pair of electrodes comprise a pair of electrodes that constitute surface conduction type electron emission elements,

wherein said electrode forming step comprises a step which includes a thin film forming step of forming an electrically conductive thin film on the substrate, and produces a gap in the electrically conductive thin film and constitutes the pair of

electrodes by the electrically conductive thin film which exists on both sides of the gap,  
and

wherein said electric field applying process is conducted before said thin film forming step is conducted.

8. (Previously Presented) A method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect the electron emission portions are disposed on a substrate, the method comprising:

a wiring forming step of forming at least one wiring on the substrate;  
and

an electron emission portion forming process of forming the electron emission portions on the substrate;

wherein an electric field applying process of applying a given electric field to the substrate on which the wiring is formed is conducted after said wiring forming step is completed and before said electron emission portion forming process is completed,

wherein said electron emission portion forming step includes an electrode forming step of forming a pair of electrodes to which different potentials are given from the wirings in correspondence with respective ones of the electron emission portions, and said electric field applying process is conducted before said electrode forming step is conducted,

wherein the pair of electrodes comprise a pair of electrodes that constitute surface conduction type electron emission elements,

wherein said electrode forming step comprises a step which includes a thin film forming step of forming an electrically conductive thin film on the substrate, and

produces a gap in the electrically conductive thin film and constitutes the pair of electrodes by the electrically conductive thin film which exists on both sides of the gap, and

wherein said electric field applying process is conducted after said thin film forming step is completed and before the gap is produced in the electrically conductive thin film.

9. (Previously Presented) The method of manufacturing the electron beam device according to claim 4, wherein the pair of electrodes comprise an emitter and a gate of the electric field emission type electron emission element.

10. (Canceled)

11. (Currently Amended) A method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect the electron emission portions are disposed on a substrate, the method comprising:

a wiring forming step of forming at least one wiring on the substrate; and

an electron emission portion forming process of forming the electron emission portions on the substrate;

wherein an electric field applying process of applying a given electric field to the substrate on which the at least one wiring is formed is conducted using an electrode opposing a surface of the substrate on which ~~[[th]]~~ the at least one wiring is formed after said wiring forming step is completed and before said electron emission portion forming process is completed, said electron emission portion forming step includes an electrode forming step of forming a pair of electrodes to which different potentials are given from said wirings in correspondence with respective ones of the electron emission portions, and

said electric field applying process is conducted before said electrode forming step is conducted, and the pair of electrodes comprise an emitter and a gate of an electric field emission type electron emission element, said electric field applying process is conducted before the emitter is formed.

12. (Previously Presented) The method of manufacturing the electron beam device according to claim 11, wherein said electric field applying process is conducted before the gate is formed.

13. (Previously Presented) The method of manufacturing the electron beam device according to claim 12, wherein the plurality of electron emission portions are connected onto one main surface of the substrate in the form of a ladder or a matrix by the wirings.

14. (Previously Presented) The method of manufacturing the electron beam device according to claim 13, wherein, in said electric field applying process, an electrode is disposed opposite to a surface of the substrate on which the wirings are disposed, and a voltage is applied between the electrode and the wirings on the substrate to apply the electric field.

15. (Previously Presented) The method of manufacturing the electron beam device according to claim 13, wherein a voltage given between the electrode and the wirings is changed during said electric field applying process.

16. (Previously Presented) A method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect the electron emission portions are disposed on a substrate, the method comprising:

- a wiring forming step of forming at least one wiring on the substrate;
- and
- an electron emission portion forming process of forming the electron emission portions on the substrate;

wherein an electric field applying process of applying a given electric field to the substrate on which the at least one wiring is formed is conducted after said wiring forming step is completed and before said electron emission portion forming process is completed,

wherein said electron emission portion forming step includes an electrode forming step of forming a pair of electrodes to which different potentials are given from the wirings in correspondence with respective ones of the electron emission portions, and said electric field applying process is conducted before said electrode forming step is conducted,

wherein the pair of electrodes comprise an emitter and a gate of the electric field emission type electron emission element,

wherein said electric field applying process is conducted before the emitter is formed,

wherein said electric field applying process is conducted before the gate is formed,

wherein the plurality of electron emission portions are connected onto one main surface of the substrate in the form of a ladder or a matrix by the wirings, and

wherein a distance between the electrode and the wirings is changed during said electric field applying process.

17. (Previously Presented) A method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect the electron emission portions are disposed on a substrate, the method comprising:

a wiring forming step of forming at least one wiring on the substrate;

and

an electron emission portion forming process of forming the electron emission portions on the substrate;

wherein an electric field applying process of applying a given electric field to the substrate on which the at least one wiring is formed is conducted after said wiring forming step is completed and before said electron emission portion forming process is completed,

wherein said electron emission portion forming step includes an electrode forming step of forming a pair of electrodes to which different potentials are given from the wirings in correspondence with respective ones of the electron emission portions, and said electric field applying process is conducted before said electrode forming step is conducted,

wherein the pair of electrodes comprise an emitter and a gate of the electric field emission type electron emission element,

wherein said electric field applying process is conducted before the emitter is formed,

wherein said electric field applying process is conducted before the gate is formed,

wherein plurality of electron emission portions are connected onto one main surface of the substrate in the form of a ladder or a matrix by the wirings, and  
wherein a current limit resistor is connected between the electrode and the power supply that applies a voltage to the electrode.

18. (Previously Presented) A method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect the electron emission portions are disposed on a substrate, the method comprising:

a wiring forming step of forming at least one wiring on the substrate;  
and

an electron emission portion forming process of forming the electron emission portions on the substrate;

wherein an electric field applying process of applying a given electric field to the substrate on which the at least one wiring is formed is conducted after said wiring forming step is completed and before said electron emission portion forming process is completed,

wherein said electron emission portion forming step includes an electrode forming step of forming a pair of electrodes to which different potentials are given from the wirings in correspondence with respective ones of the electron emission portions, and said electric field applying process is conducted before said electrode forming step is conducted,

wherein the pair of electrodes comprise an emitter and a gate of the electric field emission type electron emission element,

wherein said electric field applying process is conducted before the emitter is formed,

wherein said electric field applying process is conducted before the gate is formed,

wherein the plurality of electron emission portions are connected onto one main surface of the substrate in the form of a ladder or a matrix by the wirings, and

wherein said electric field applying process is conducted in a vacuum atmosphere.

19. - 101. (Canceled)

102. (Previously Presented) A method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect the electron emission portions are disposed on a substrate, the method comprising:

a wiring forming step of forming at least one wiring on the substrate; and

an electron emission portion forming process of forming the electron emission portions on the substrate;

wherein an electric field applying process of applying a given electric field to the substrate on which the at least one wiring is formed is conducted after said wiring forming step is completed and before said electron emission portion forming process is completed,

wherein said electron emission portion forming step includes an electrode forming step of forming a pair of electrodes to which different potentials are given from the wirings in correspondence with respective ones of the electron emission portions, and said electric field applying process is conducted before said electrode forming step is conducted,

wherein the pair of electrodes comprise an emitter and a gate of the electric field emission type electron emission element,

wherein the electric field emission type electron emission element comprises the emitter that emits electrons from an end portion and the gate that produces an electric field between the end portion and the gate,

wherein said electric field applying process is conducted before the emitter is formed,

wherein said electric field applying process is conducted before the gate is formed,

wherein the plurality of electron emission portions are connected onto one main surface of the substrate in the form of a ladder or a matrix by the wirings, and

wherein a distance between the electrode and the wirings is changed during said electric field applying process.

103. (Previously Presented) The method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect said electron emission portions are disposed on a substrate, the method comprising:

a wiring forming step of forming at least one wiring on the substrate;  
and

an electron emission portion forming process of forming the electron emission portions on the substrate;

wherein an electric field applying process of applying a given electric field to the substrate on which the at least one wiring is formed is conducted after said wiring forming step is completed and before said electron emission portion forming process is completed,

wherein said electron emission portion forming step includes an electrode forming step of forming a pair of electrodes to which different potentials are given from the wirings in correspondence with respective ones of the electron emission portions, and said electric field applying process is conducted before said electrode forming step is conducted,

wherein the pair of electrodes comprise an emitter and a gate of the electric field emission type electron emission element,

wherein said electric field emission type electron emission element comprises the emitter that emits electrons from an end portion and the gate that produces an electric field between the end portion and the gate,

wherein said electric field applying process is conducted before the emitter is formed,

wherein said electric field applying process is conducted before the gate is formed,

wherein the plurality of electron emission portions are connected onto one main surface of the substrate in the form of a ladder or a matrix by the wirings,  
and

wherein a current limit resistor is connected between the electrode and the power supply that applies a voltage to the electrode.

104. (Previously Presented) A method of manufacturing an electron beam device in which electron emission portions that emit electrons and wirings that electrically connect the electron emission portions are disposed on a substrate, the method comprising:

a wiring forming step of forming at least one wiring on the substrate;

and

an electron emission portion forming process of forming the electron emission portions on the substrate;

wherein an electric field applying process of applying a given electric field to the substrate on which the at least one wiring is formed is conducted after said wiring forming step is completed and before said electron emission portion forming process is completed,

wherein said electron emission portion forming step includes an electrode forming step of forming a pair of electrodes to which different potentials are given from the wirings in correspondence with respective ones of the electron emission portions, and said electric field applying process is conducted before said electrode forming step is conducted,

wherein the pair of electrodes comprise an emitter and a gate of the electric field emission type electron emission element,

wherein the electric field emission type electron emission element comprises the emitter that emits electrons from an end portion and the gate that produces an electric field between the end portion and the gate,

wherein said electric field applying process is conducted before the emitter is formed,

wherein said electric field applying process is conducted before the gate is formed,

wherein the plurality of electron emission portions are connected onto one main surface of the substrate in the form of a ladder or a matrix by the wirings, and

wherein said electric field applying process is conducted in a vacuum atmosphere.

105. (Previously Presented) The method of manufacturing the electron beam device according to claim 11, wherein the electric field emission type electron emission element comprises the emitter that emits electrons from an end portion and the gate that produces an electric field between the end portion and the gate.

106. (New) A method of manufacturing an image forming apparatus provided with a rear plate on which an electron emitting portion emitting at least one electron and a wiring connected electrically to the electron emitting portion are disposed, and a face plate on which an image forming member is disposed, the method comprising:

a wiring forming step of forming the wiring on the rear plate;

an electron emitting portion forming step of forming the electron emitting portion on the rear plate;

a sealing step of sealing between the rear plate and the face plate on which the image forming member is disposed; and

a voltage applying step wherein, after completing the wiring forming step, before the electron emitting portion forming step and the sealing step, an electrode is disposed in opposition to the rear plate on which the wiring is disposed, and a voltage is applied between the electrode and the rear plate,

wherein the voltage applying step is conducted to cause an electrical discharging between the electrode and the rear plate.

107. (New) A method of manufacturing an image forming apparatus provided with a rear plate on which an electroconductive film having an electron emitting portion emitting at least one electron and a wiring connected electrically to the electroconductive film are disposed, and a face plate on which an image forming member is disposed, the method comprising:

a wiring forming step of forming the wiring on the rear plate;

an electroconductive film forming step of forming the electroconductive film electrically connected to the wiring on the rear plate;

an electron emitting portion forming step of forming the electron emitting portion on the electroconductive film after the electroconductive film forming step;

a sealing step of providing sealing between the rear plate and the face plate on which the image forming member is disposed; and

a voltage applying step wherein, after completing the wiring forming step and the electroconductive film forming step, before the electron emitting portion forming step and the sealing step, an electrode is disposed in opposition to the rear plate on which the wiring and the electroconductive film are disposed, and a voltage is applied between the electrode and the rear plate,

wherein the voltage applying step is conducted to cause an electrical discharging between the electrode and the rear plate.

108. (New) A method of manufacturing an image forming apparatus provided with a rear plate on which are disposed a pair of device electrodes, an electroconductive film disposed between the pair of device electrodes and having an electron emitting portion emitting at least one electron and a wiring connected electrically to the pair of device electrodes, and a face plate on which an image forming member is disposed, the method comprising:

a wiring forming step of forming the wiring on the rear plate;

a device electrode forming step of forming the pair of device electrodes connected electrically to the wiring on the rear plate;

an electroconductive film forming step of forming the electroconductive film between the pair of device electrodes on the rear plate;

an electron emitting portion forming step of forming the electron emitting portion on the electroconductive film after the electroconductive film forming step;

a sealing step of providing sealing between the rear plate and the face plate on which the image forming member is disposed; and

a voltage applying step wherein, after completing the wiring forming step and the device electrode forming step, before the electron emitting portion forming step and the sealing step, an electrode is disposed in opposition to the rear plate on which the wiring and the device electrodes are disposed, and a voltage is applied between the electrode and the rear plate,

wherein the voltage applying step is conducted to cause an electrical discharging between the electrode and the rear plate.

109. (New) A method of manufacturing an image forming apparatus provided with a rear plate on which are disposed a pair of device electrodes, an electroconductive film disposed between the pair of device electrodes and having an electron emitting portion emitting at least one electron and a wiring connected electrically to the pair of device electrodes, and a face plate on which an image forming member is disposed, the method comprising:

a wiring forming step of forming the wiring on the rear plate;

a device electrode forming step of forming the pair of device electrodes connected electrically to the wiring on the rear plate;

an electroconductive film forming step of forming the electroconductive film between the pair of device electrodes on the rear plate;

an electron emitting portion forming step of forming the electron emitting portion on the electroconductive film after the electroconductive film forming step;

a sealing step of providing sealing between the rear plate and the face plate on which the image forming member is disposed; and

a voltage applying step wherein, after completing the wiring forming step, the device electrode forming step and the electroconductive film forming step, before the electron emitting portion forming step and the sealing step, an electrode is disposed in opposition to the rear plate on which the wiring, the device electrodes and the electroconductive film are disposed, and a voltage is applied between the electrode and the rear plate,

wherein the voltage applying step is conducted to cause an electrical discharging between the electrode and the rear plate.

110. (New) The method according to claim 107, wherein the electron emitting portion forming step for forming the electron emitting portion on the electroconductive film is a step of forming a gap in the electroconductive film.

111. (New) The method according to claim 110, wherein the step of forming the gap in the electroconductive film includes a step of energizing the electroconductive film.

112. (New) The method according to claim 110, wherein after the step of forming the gap in the electroconductive film, a further step of depositing a deposit on or in a vicinity of the electron emitting portion is conducted.

113. (New) The method according to claim 106, wherein the voltage applying step is a step of applying an electric field of 1kV/m or greater between the electrode and the rear plate.

114. (New) The method according to claim 107, wherein the voltage applying step is conducted such that, at applying a voltage between the electrode and the rear plate, an energy stored in a capacitor formed by

the electrode and the rear plate is smaller than an energy which destroys the electroconductive film.

115. (New) The method according to claim 114, wherein an area S where the electrode and the rear plate face each other, a distance Hc between the electrode and the rear plate, a voltage Vc applied between the electrode and the wiring, a dielectric constant  $\epsilon$  of a vacuum, and an energy Eth by which the electrically conductive thin film is destroyed, meet following condition:

$$\epsilon \times S \times Vc^2 / 2Hc < Eth \dots (1).$$

116. (New) The method according to claim 106, wherein the voltage applied between the electrode and the rear plate changes during the voltage applying step.

117. (New) The method according to claim 116, wherein the voltage is a D.C. voltage gradually increasing from a lower voltage.

118. (New) The method according to claim 116, wherein the voltage is an A.C. voltage gradually increasing from a lower voltage.

119. (New) The method according to claim 116, wherein the voltage is a pulse voltage gradually increasing from a lower voltage.

120. (New) The method according to claim 116, wherein  
a distance between the electrode and the rear plate is changed during  
the voltage applying step.

121. (New) The method according to claim 106, wherein  
the voltage applying step is conducted within a depressurized  
atmosphere.

122. (New) The method according to claim 106, wherein  
the voltage applying step is conducted within a gas containing  
atmosphere.